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# ENQUIRIES

INTO THE

NATURE

OF

## A New Mineral Acid,

DISCOVERED IN SWEDEN;

AND

Of the STONE from which it is obtained.

To which is annexed,

An IDEA of an ARTIFICIAL ARRANGEMENT,

AND OF

A NATURAL METHOD of FOSSILS;

WITH

EXAMPLES in the CRYSTALS, SPARS, and EARTHS.

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## OBSERVATIONS

ON

The new-discovered SWEDISH ACID;

AND ON

The Stone from which it is obtained.

## S E C T. I.

Of the MINERAL ACID in general.

**T**HERE exists in the Mineral World a native Acid; and probably only one; tho' it exhibits itself under different Forms.

Of the Existence of this we are certain; altho' we never have seen it pure; nor can: It never becoming an Object of our Senses, but in Mixture with other Bodies. It has been called the *Vague Acid*, and the *Universal Acid*.



We have been accustomed to meet with it under two distinct Forms ; and to know it under the Names of two Species : These are the *Vitriolic* and the *Muriatic Acid* : And to these we are lately taught to add a third, which, from the Place where it has been discovered, Authors have called the *Swedish Acid* ; and to which some, tho' very improperly, have given the Name of the *Sparry Acid*. Perhaps, in distinction from the other two, it may be better named the *Stony Acid* ; since the Substance from which we obtain it is a Stone ; tho' not a Spar.

There are many who hold these Acids to be essentially distinct. Perhaps they are so : But it seems more probable, that they are only different Modifications of one and the same Spirit : And perhaps it will not be carrying the Opinion too far to suppose this one universal Acid to be the Basis also, and Foundation of the nitrous ; and even of the animal and vegetable Acids, the urinous, the fermented, &c.

Chymists of great Knowledge have proved the very near Relation between the vitriolic, and the nitrous Acid ; and some by fair Experiments have also shewn there is a great Analogy between the nitrous and the marine or muriatic. They have endeavoured to prove, from these Experiments, that the nitrous, and the vitriolic on the one Part, and that the nitrous and muriatic, on the other, have so great Uniformity in many Instances, that they must be derived the one from the other : But  
it

it should seem most agreeable to Nature, to refer both; as also the new-discovered Acid of Stone; to one and the same general Principle; of which they all three partake, altho' each has its own distinctive Qualities from the others; and to determine that they all originate from, or are merely different Modifications of, the same original Principle, the *universal Acid*.

This we may at all Times meet with in the three separate and distinct Forms already mentioned, vitriolic, muriatic, and stony; tho' no Man ever saw it separate and in its own. We see it,

1. Combined with Metal, under the Form of Vitriol.

2. With an alkaline Earth, in the Condition of Fossile or Sea Salt.

And, 3dly, With a stony Substance, under the Form of this new-discovered Stone.

From all these Substances we can obtain it by Means of Distillation; united with more or less Water. And this is the only Condition in which we have, or can have any Acquaintance with it. From whichever of these Substances we thus produce it, there are certain general Properties in which it agrees: As also certain Powers or Qualities by which it differs; according to the one or other of these Bodies from which it is drawn.

From whichever of these Substances it is produced, it is sour, acrid, and dissolvent; but in different Degrees, from the various



Kinds: And beside, it is separately endowed with different Characters from each.

Distilled from Vitriol, it is unctuous, heavy, and very corrosive: And after dissolving calcareous Earth, forms with it a Selenite. In its concentrated State it dissolves Silver, Tin, &c. when diluted, Copper, and Iron.

Distilled from Salt, it is not unctuous; is little heavier than common Water; less corrosive than from Vitriol; and after dissolving calcareous Earth, forms with it, not Selenite, but a fixed Sal Armoniac. In its concentrated State it dissolves Lead, &c.

Distilled from the *Swedish* Stone, it is heavier than Acid of Salt, less heavy than the Vitriolic. It dissolves the Calxes of Metals more readily than Metals themselves. In the very Act of Distillation, it corrodes Glafs; and the Stone itself, mixed with a calcareous Earth, becomes a peculiarly corrosive Matter, which dissolves the best and strongest Crucibles.

## S E C T. II.

Of the Stone from which the SWEDISH ACID  
is obtained.

**T**H E Stone is of a peculiar Genus, differing both from Crystal and Spar; and demands a distinct Place and Name; as well from its natural Character, as for its artificial Products: It has been called *Fluor*, *Spatum vitrescens*, and *Fluss*. It is heavy, unctuous, soft, semi-transparent, and glossy: It breaks in a rudely plated Form; not rhombic.

We find it in large Masses; or Clusters of smaller Lumps; in some Degree resembling Spar, and of the like glossy Surface; but without the peculiar Form, or real Characters of that Stone.

A Knife will scratch it: It does not readily ferment with Acids, nor will it strike Fire with Steel: It neither burns to Glass, nor Lime; but exposed to the Action of a violent Fire, it splits into thin, irregular, flaky Fragments, and by Degrees crumbles into a Kind of Powder, over which the Fire has no farther Power. The Fragments do not this Way burn to Lime, nor can a calcareous Substance be any way extracted from them: But tho' no Fire will vitrify it alone, yet mixed with a calcareous Earth we see it runs freely into a Glass. And that it is of a  
peculiar



peculiar Nature, and in particular so corrosive that it dissolves all Vessels, in this State; just as, mixed with the vitriolic Acid, it does the Glass of the Retort in the usual Distillation. Mixed with crude Ores, it wonderfully promotes their Fusion.

A Degree of Fire sufficient to make the Stone red hot, destroys that phosphoric Light it yields when gradually and gently warmed. Slowly heated, it is phosphoric, as long as it continues warm: And it burns with a blue Flame without Smell. From these invariable Characters it is plain, that it is neither Crystal, Spar, Talc, or Selenite; but a distinct Genus of Fossil from them all.

It is found green, yellow, white, blue, and violet coloured. The green and yellow are common in *Sweden*: There is a deep green in *Saxony*: The blue is frequent in *China*; and there is some in *Bohemia*: The white and the violet-coloured we have in *England*.

The fossile Bodies that approach nearest to its Nature, are the *Swedish Zeolite*; the *Bolonian Phosphorus Stone*; and our Star upon the waxen Vein.

But the Zeolite dissolves in Acids;

The *Bolonian Stone* effervesces readily with them, tho' it be not soluble; and the Star burns to Plaister.

No one of all which Properties belong to this new Stone.

The Zeolite is phosphoric, just as it melts;

And



And the Star does not dissolve or effervesce with Acids : In these Things the two approach to the new Stone ; but neither can be allowed the same.

The green owes its Colour, mostly, to Iron.

I am convinced that some of this Stone contains that Metal ; but not all ; and that the Iron, where it is found, is no Essential Part of the Body ; but a mere accidental Mixture : For I have Pieces from *Sweden*, which, tho' very green, do not become red in burning ; and other green Pieces that acquire that Redness, which appears after burning in all Fossils that have Iron in them.

The yellow holds a little Lead.

The blue does not owe its Colour to Copper ; as is true also of the *Lapis Lazuli* ; which is a Zeolite ; and therefore allied to this Stone.

Of whatsoever Colour this Stone be, if carefully warmed, it has the electric Quality ; less than the Tourmatine ; but like it ;

It has not the double Refraction of Spar ; though it has much of its external Aspect.

From these palpable Qualities ; and certain Characters ; we may advance toward an Enquiry into what it is.

The Mineral Acid, every where present in the Earth, (tho' never seen unmixed ; or in its pure, simple state) when joined with Metals, we see, forms the Vitriols ; when united with Clay it makes the Alums ; when mixed with  
any

any Thing inflammable, it constitutes the Sulphurs; and when united with calcareous Earth, the Selenites.

Now, as this Acid can unite with Clay, and with Chalk; there is nothing contradictory to Reason, in supposing it may join also with an earthy or stony Substance, neither argillaceous or calcareous:

And as uniting with Clay it forms Alums, and with Chalk Selenites; if united with an Earth totally different in its Nature from these two, it will form a Body also different both from Alum, and from Selenite.

I am therefore led to suppose, that this Stone is a Combination of the universal Acid, with an Earth, differing from those wherewith we have at other Times seen it joined.

And from

1. The unctuous Quality of the Stone;
2. Its Difficulty of Fusion;
3. Its tenacious and gelatinous Nature in the Fire;
4. From its various Colours;

I think it most probable, that it is the Mineral Acid united with the Steatite; or Soap Rock.

For the Steatites has precisely all the Colours which we see in this Stone; and has no others: It is unctuous like it; it scratches like it, in the hardest Pieces; it will not dissolve in Acids; nor strike Fire with Steel: And in the last fiery Trial it has just this refractory Quality; only that here it is rendered a little more tractable by the Acid.



A Stone thus formed must have Qualities very different from all others : And such this affords on Trial.

There rises from it in Distillation an Acid, different from the vitriolic, nitrous, or saline.

And also a solid Sublimation ; of a Stone-like Nature ; utterly unknown from any other Substance.

The Process by which I tried the Substance was this :

Two Pounds of the green Kind of the Stone were powdered, and put into a Glass Retort ;

Two Pounds of Oil of Vitriol were added to this ;

And a Quart of Spirit of Wine was put into the Receiver.

No Heat, nor Ebullition whatsoever, followed the Mixture for some Time ; and in the End but little.

The Vessels were closed ; and kept in a Reverberatory Furnace for fourteen Hours.

The Fire was slow at first ; else the Matter would have risen over.

No phosphorescent Light was visible at any Time.

The Fumes were at some Times visible, in the Receiver ; at others not. Whereas in the marine Acid they are never visible ; unless Air be admitted.

They were elastic ; and had a Smell like those from Spirit of Salt.

The Surface waved, and rose a little ; and there was on it an icy, and gelatinous Substance.

The



The upper Part of the Receiver became covered with a thin stony Cruft.

The *Swedes* speak of a Cruft of absolute Flint, upon the Surface of the Liquor in the Receiver: But they put Water there: This was the same Substance: And it remained fix'd on Part of the Receiver: While Part was displaced; probably by some light Vapour from the Spirit of Wine.

The Corrosion of the Glass of the Retort seems to be an Effect of that peculiar Sublimation which rises in the Distillation; nay, and begins to rise, even without that Operation: For watching attentively the Effect of mixing the vitriolic Acid with the Stone, I perceived, that tho' they seemed to meet without any Effervescence, yet by Degrees there appeared a slight Commotion; which increased for a considerable Time, and, during which, this strange Sublimation of the Flores began to be made; and increased with it; even before any Fire was used.

Repeating this Trial, and breaking the Retort afterwards, no Fire at all having been used, I found it corroded in Waves; where the Flores had adhered to the Neck, and eaten in very deeply, just at the Surface of the Matter.

The Flores themselves are extremely acrid to the Taste, and are indissoluble in any Acid; nor can be run into Glass by any Fire.

The Acid of this Stone in its purest State, so far as I have seen it, is about one third heavier than Water.

After seven Hours a Hole was eaten thro' the Retort, and Fumes issued: But this was soon closed

closed by a Crust formed of the Matter within; and so well stopped, that no Vapour escaped.

After this the Retort became corroded in a great many Places: Fumes issued, at them all, for a little While; but they were afterwards stopped by Crusts of the same Kind as the former.

When the Operation was finished, there were found in the upper Part of the Retort a Kind of Flowers, dry and powdery; and in the Neck a thick, slimy, moist Substance.

The Retort was corroded all round, just above the Top of the Residuum; and this corroded Part crumbled to Dust between the Fingers; having lost the Nature of Glass.

Here then is found a Fossil capable of dissolving Glass; a Power not known in any other Body:

Subliming an absolute Stone during the Distillation; a Quality equally unknown in other Bodies:

And burning with a violet, scentless Flame: A Thing equally unknown; and the more strange, as the Stone holds no Copper.

To shew the violet Flame, some of the Stone is to be broken small with a Hammer; and sprinkled on a red hot Heater, in the dark: The Flame rises very freely, and continues some Time; and the Stone splits into thin irregular Flakes

The Uses of the pure Acid may be infinite: And it is easy to see the Knowledge of this Subject will lead us to a thousand unknown Truths in the Mineral History.

The



The Uses of the Stone itself may also be immense. We are well informed that the Steatites, and a Fossil of the Nature of the *Bolonian* Stone, are great Ingredients in Porcelaine. This Substance seems to promise all that can be wished, without any farther Mixture. For the Matter in the Neck of the Retort, when hardened, differs little from the Substance of *China* Ware.

In Mineralogy there are laid open to us also a thousand Articles of Wonder; which naturally perplexed us before we were acquainted with this Stone: Because, not knowing this, which was the true Source of them, it was impossible that we should guess how they were performed.

LEHMAN, in a very excellent Letter to *Monf. BUFFON*, on the Subject of a red Ore of Lead found in *Siberia*, entertains a Conjecture, not only that this in particular, but many others, owe a great deal of their Qualities and Particularities to the Marine Acid. The Conjecture was good; but 'tis easy now to see, by numerous Instances, that the Acid, suspected by many, and absolutely discovered by this able Chymist, as performing many and great Things in the mineral World, is not the muriatic, but this stony Acid; present in a thousand Places where we do not suspect it; and performing a Multitude of Things which must have been unintelligible, and therefore wonderful to us, so long as we were not acquainted with it; or indeed knew of its Existence.